

University of Bahrain
College of Information Technology
Department of Computer Engineering

ITCE 202: Digital Logic
Test 1

Time: 1 hour

Date: April 6th, 2004

Show all your work.
DO NOT USE CALCULATORS

Q1-

- a) **(8-points)** Represent the following decimal numbers as 8-bits signed binary numbers in sign-magnitude, one's complement and two's complement format.

Decimal	sign-magnitude	one's complement	two's complement
+ 79			
- 49			

- b) **(4 points)** Convert from Octal to BCD $(3.4)_8 = (\quad)_{\text{BCD}}$
c) **(6 point)** Convert $(8A9D)_{16} = (\quad)_4$
 $= (\quad)_8$
d) **(6 points)** Perform the following addition in binary using 7-bit 2's complement representation. Indicate if there is an overflow.
 $(-31) + (-56)$
e) **(6 points)** Perform the following addition in BCD
 $947 + 735$

Q2-

- a) **(10 points)** Draw the logic circuit that corresponds to the following logic function (Do not Simplify).

$$F = \overline{\left[(A + B \cdot C) \oplus (A + B + C) \right]} \cdot A \cdot \overline{C} + D$$

- b) **(7 points)** Simplify the following expression to a minimum sum of products.

- c) **(8 points)** Given that $F = W \cdot X \cdot \left[Y \cdot (\overline{X} + W) + \overline{Y \cdot Z} \right] + \overline{V}$

Use DeMorgan's theorem to find \overline{F} and express \overline{F} in a sum of products form.

Q3- Consider the following Boolean function:

$$F(A, B, C, D) = \sum m(0, 2, 4, 5, 7, 8, 10, 14, 15) + \sum d(6, 13)$$

Express F in:

- a) **(14 points)** Minimum Sum of products.
b) **(6 points)** Minimum Product of sums.

Q4- (25 points)

Given that:

$$F(A, B, C, D) = (B + C)(\overline{A} + \overline{C} + D)(\overline{A} + B)$$

- a) Implement F as a minimum 2-level NAND gate network.
b) Using the minimum number of 2-input NOR gates only.